

We claim:

1. A method comprising:  
creating a device template using a template language written in XML

5 syntax; and

defining, from the device template, a device description for a self-  
describing network device.

10 2. A method as recited in claim 1, wherein the template language is  
derived from XML schema.

3. A method as recited in claim 1, wherein the self-describing  
network device comprises a universal plug and play device.

15 4. A method as recited in claim 1, further comprising storing the  
device description on a computer-readable medium.

5. A method as recited in claim 1, further comprising:  
creating a service template from a template language written in XML

20 syntax; and

defining, from the service template, a service description for a service  
supported by the self-describing network device.

25 6. A method as recited in claim 1, further comprising automatically  
evaluating, via a computer software tool, whether the device description is well  
formed.

7. A method comprising:

creating a service template from a template language written in XML syntax; and

defining, from the service template, a service description for a service supported by a self-describing network device.

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8. A method as recited in claim 7, wherein the template language is derived from XML schema.

9. A method as recited in claim 7, wherein the self-describing network device comprises a universal plug and play device.

10. A method as recited in claim 7, further comprising storing the service description on a computer-readable medium.

11. A method as recited in claim 7, further comprising automatically evaluating, via a computer software tool, whether the device description is well formed.

12. A method comprising:  
creating a device template for a self-describing network device, the device template being written in an XML-based language; and  
instantiating the device template with vendor-specific information to form a device description of the self-describing network device.

13. A method of describing a universal plug and play device, comprising:  
storing a description of the self-describing network device, the description comprising a set of elements to describe the self-describing network device and an XML-based syntax that structures the set of elements such that,

when the data structure is read by a computing device, the computing device can learn about the self-describing network device; and  
making the description available to the computing device.

5           14. A method as recited in claim 13, wherein the storing comprises storing the description at the self-describing network device.

15. A method as recited in claim 13, wherein the self-describing network device comprises a universal plug and play device.

10           16. A method as recited in claim 13, wherein the set of elements includes at least one of:  
a first element to identify one or more versions of the template language;  
a second element to identify the self-describing network device; and  
15 a third element to specify a base universal resource locator (URL).

17. A method as recited in claim 16, wherein the second element includes at least one of:  
a first subelement to specify a type of self-describing network device;  
20 a second subelement to identify a user;  
a third subelement to identify a manufacturer;  
a fourth subelement to specify a URL of a website for the manufacturer;  
a fifth subelement to provide a word description of the self-describing network device for the user;  
25 a sixth subelement to specify a model name of the self-describing network device;  
a seventh subelement to specify a model number of the self-describing network device;

an eighth subelement to specify a URL of a website for the self-describing network device;

a ninth subelement to specify a URL of a website for a presentation hosted by the self-describing network device;

5 a tenth subelement to specify a serial number of the self-describing network device;

an eleventh subelement to specify a universal device name of the self-describing network device;

10 a twelfth subelement to specify a universal product code of the self-describing network device;

a thirteenth subelement to specify any icons associated with the self-describing network device;

a fourteenth subelement to identify any of one or more services supported by the self-describing network device; and

15 a fifteenth subelement to identify any of one or more devices embedded within the self-describing network device.

18. A method as recited in claim 13, further comprising storing a set of elements to describe at least one service supported by the self-describing  
20 network device.

19. A method as recited in claim 18, wherein the set of elements to describe the service includes at least one of:

25 a first element to identify any of one or more actions performed by the service; and

a second element to identify any of one or more state variables in the service.

20. A method as recited in claim 19, wherein the first element includes at least one subelement for each corresponding action, the subelement containing a name string to hold a name of the action and an argument list to hold parameters of the action.

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21. A method as recited in claim 19, wherein the second element includes at least one of:

- a first subelement to identify a name of a state variable;
- a second subelement to specify a data type of the state variable;
- a third subelement to specify a default value of the state variable;
- a fourth subelement to enumerate legal string values; and
- a fifth subelement to define bounds of legal numeric values.

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22. A method as recited in claim 13, wherein the storing comprises storing the description at the self-describing network device, the method further comprising storing a set of elements to describe at least one service supported by the self-describing network device at a location remote from the self-describing network device.

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23. A data structure stored on a computer-readable medium, the data structure being constructed according to an XML-based template language, the data structure comprising:

- a set of elements to describe a self-describing network device; and
- an XML-based syntax that organizes and structures the set of elements

such that, when the data structure is read by a computing device, the computing device can learn about the self-describing network device.

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24. A data structure stored as recited in claim 23, wherein the set of elements requires:

a first element to identify one or more versions of the template language;  
and  
a second element to identify the self-describing network device.

5           25.   A data structure stored as recited in claim 23, wherein the set of elements includes at least one of:

a first element to identify one or more versions of the template language;  
a second element to identify the self-describing network device; and  
a third element to specify a base universal resource locator (URL).

10           26.   A data structure stored as recited in claim 25, wherein the second element includes at least one of:

a first subelement to specify a type of self-describing network device;  
a second subelement to identify a user;  
15           a third subelement to identify a manufacturer;  
a fourth subelement to specify a URL of a website for the manufacturer;  
a fifth subelement to provide a word description of the self-describing network device for the user;

20           a sixth subelement to specify a model name of the self-describing network device;

a seventh subelement to specify a model number of the self-describing network device;

an eighth subelement to specify a URL of a website for the self-describing network device;

25           a ninth subelement to specify a URL of a website for a presentation hosted by the self-describing network device;

a tenth subelement to specify a serial number of the self-describing network device;

an eleventh subelement to specify a universal device name of the self-describing network device;

a twelfth subelement to specify a universal product code of the self-describing network device;

5        a thirteenth subelement to specify any icons associated with the self-describing network device;

a fourteenth subelement to identify any of one or more services supported by the self-describing network device; and

10       a fifteenth subelement to identify any of one or more devices embedded within the self-describing network device.

27.    A data structure stored on a computer-readable medium, the data structure being constructed according to an XML-based template language, the data structure comprising:

15       a set of elements to describe a service supported by a self-describing network device; and

an XML-based syntax that organizes and structures the set of elements such that, when the data structure is read by a computing device, the computing device can learn about the service supported by the self-describing  
20    network device.

28.    A data structure stored as recited in claim 27, wherein the set of elements includes at least one of:

25       a first element to identify any of one or more actions performed by the service; and

a second element to identify any of one or more state variables in the service.

29. A data structure stored as recited in claim 28, wherein the first element includes at least one subelement for each corresponding action, the subelement containing at least one of a name string to hold a name of the action, an argument list to hold parameters of the action, and a data type of the parameters.

30. A data structure stored as recited in claim 28, wherein the second element includes at least one of:

- a first subelement to identify a name of a state variable;
- a second subelement to specify a data type of the state variable;
- a third subelement to specify a default value of the state variable;
- a fourth subelement to enumerate legal string values; and
- a fifth subelement to define bounds of legal numeric values.

31. One or more computer-readable media, comprising stored thereon:  
a first set of elements to describe a self-describing network device, the first set of elements being written in an XML syntax;

a second set of elements to describe a service supported by the self-describing network device, the second set of elements being written in an XML syntax; and

a code segment that, when executed, returns the first set of elements and at least a reference to the second set of elements to an entity requesting a description of the self-describing network device.

32. One or more computer-readable media as recited in claim 31, wherein the first set of elements are stored on a computer-readable media located at the self-describing network device and the second set of elements are stored on a separate computer-readable medium located remotely from the self-describing network device, but accessible via a network.



33. One or more computer-readable media as recited in claim 31,  
wherein the first set of elements includes at least one of:

- a first element to identify one or more versions of the template language;
- a second element to identify the self-describing network device; and
- a third element to specify a base universal resource locator (URL).

34. One or more computer-readable media as recited in claim 31,  
wherein the second element of the first set of elements includes at least one  
of:

- a first subelement to specify a type of self-describing network device;
- a second subelement to identify a user;
- a third subelement to identify a manufacturer;
- a fourth subelement to specify a URL of a website for the manufacturer;
- a fifth subelement to provide a word description of the self-describing  
network device for the user;
- a sixth subelement to specify a model name of the self-describing  
network device;
- a seventh subelement to specify a model number of the self-describing  
network device;
- an eighth subelement to specify a URL of a website for the self-  
describing network device;
- a ninth subelement to specify a URL of a website for a presentation  
hosted by the self-describing network device;
- a tenth subelement to specify a serial number of the self-describing  
network device;
- an eleventh subelement to specify a universal device name of the self-  
describing network device;

a twelfth subelement to specify a universal product code of the self-describing network device;

a thirteenth subelement to specify any icons associated with the self-describing network device;

5        a fourteenth subelement to identify any of one or more services supported by the self-describing network device; and

a fifteenth subelement to identify any of one or more devices embedded within the self-describing network device.

10        35. One or more computer-readable media as recited in claim 31, wherein the second set of elements includes at least one of:

a first element to identify any of one or more actions performed by the service; and

15        a second element to identify any of one or more state variables in the service.

20        36. One or more computer-readable media as recited in claim 35, wherein the first element of the second set of elements includes at least one subelement for each corresponding action, the subelement containing a name string to hold a name of the action and an argument list to hold parameters of the action.

25        37. One or more computer-readable media as recited in claim 35, wherein the second element of the second set of elements includes at least one of:

a first subelement to identify a name of a state variable;

a second subelement to specify a data type of the state variable;

a third subelement to specify a default value of the state variable;

a fourth subelement to enumerate legal string values; and

a fifth subelement to define bounds of legal numeric values.

38. One or more computer-readable media as recited in claim 31,  
wherein the code segment is configured to respond to an HTTP GET request by  
5 returning the description in a body of an HTTP response.

39. A self-describing network device comprising:

a memory;

a description of the self-describing network device stored in the memory,

10 the description comprising a set of elements written in an XML syntax to  
describe the self-describing network device; and

a processor coupled to the memory to submit the description to a remote  
entity on a network.

15 40. A self-describing network device as recited in claim 39, wherein  
the description data comprises a first set of elements a first set of elements to  
describe the self-describing network device and a second set of elements to  
describe a service supported by the self-describing network device.

20 41. A self-describing network device as recited in claim 39, wherein  
the set of elements comprises at least one of:

a first element to identify one or more versions of the template language;

a second element to identify the self-describing network device; and

a third element to specify a base universal resource locator (URL).

25 42. A self-describing network device as recited in claim 41, wherein  
the second element includes at least one of:

a first subelement to specify a type of self-describing network device;

a second subelement to identify a user;

a third subelement to identify a manufacturer;  
a fourth subelement to specify a URL of a website for the manufacturer;  
a fifth subelement to provide a word description of the self-describing network device for the user;

5 a sixth subelement to specify a model name of the self-describing network device;

a seventh subelement to specify a model number of the self-describing network device;

10 an eighth subelement to specify a URL of a website for the self-describing network device;

a ninth subelement to specify a URL of a website for a presentation hosted by the self-describing network device;

a tenth subelement to specify a serial number of the self-describing network device;

15 an eleventh subelement to specify a universal device name of the self-describing network device;

a twelfth subelement to specify a universal product code of the self-describing network device;

20 a thirteenth subelement to specify any icons associated with the self-describing network device;

a fourteenth subelement to identify any of one or more services supported by the self-describing network device; and

a fifteenth subelement to identify any of one or more devices embedded within the self-describing network device.

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43. A self-describing network device as recited in claim 39, wherein the set of elements includes at least one of:

a first element to identify any of one or more actions performed by a service supported by the self-describing network device; and

a second element to identify any of one or more state variables in the service.

44. A self-describing network device as recited in claim 43, wherein  
5 the first element includes at least one subelement for each corresponding action, the subelement containing a name string to hold a name of the action and an argument list to hold parameters of the action.

45. A self-describing network device as recited in claim 43, wherein  
10 the second element includes at least one of:

- a first subelement to identify a name of a state variable;
- a second subelement to specify a data type of the state variable;
- a third subelement to specify a default value of the state variable;
- a fourth subelement to enumerate legal string values; and
- 15 a fifth subelement to define bounds of legal numeric values.

46. A self-describing network device comprising:  
storage means for storing a description of the self-describing network  
device, the description comprising a set of elements to describe the self-  
20 describing network device and an XML-based syntax that structures the set of elements such that, when the data structure is read by another computing device, the computing device can learn about the self-describing network device; and

responsive means for making the description available to another  
25 computing device.